



**PATENT**

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

In re Application of

Palakodati et al.

Serial No. 10/041,094

Filing Date: December 28, 2001

Entitled: ELECTRIC POWER ASSIST  
STEERING SYSTEM WITH ROLLER  
GEARBOX

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) Examiner: Tony H. Winner  
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) Atty. Docket: 10541-183  
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Commissioner For Patents  
P.O. Box 1450  
Alexandria, CA 22313-1450

**DECLARATION UNDER 37 CFR §1.132 OF EDWARD FRANCIS McELMEEL**  
Sir:

I, Edward Francis McElmeel, hereby declare the following:

1. I am a co-inventor of the subject application and understand the inventions for which patent protection is sought. For the following reasons, the recited invention is not taught, suggested or made obvious by the prior art, including the cited art.
2. I am currently a Product Design Engineer for the assignee of the subject inventions, Visteon Global Technologies, Inc. ("Visteon"). I have worked in the field of Product Design since 1989, including holding previous positions in the field with ITT Automotive and Ford. I earned a Bachelor of Science degree in Mechanical Engineering from Lawrence Technological University. In addition to my current responsibilities for Visteon, I am studying to obtain a Master of Science degree in Engineering at Purdue University via a program at Visteon.
3. Visteon produces automotive parts, including parts for power assist steering systems ("the field").
4. I have become familiar with many devices in the field and their methods of construction, and one of my focused interests since 1997 has been electric power assist steering systems. I helped develop and patent improvements in the field.

For example, I am a co-inventor of a Modular Electric Steering Gear Assembly claimed in U.S. Patent 6,520,274, which is assigned to Visteon.

5. In the field, we have sought to produce devices at minimum cost that have maximum performance, without compromising fuel efficiency and safety if not enhancing both.
6. A typical electric power assist steering ("EPAS") system uses a gear reducer/torque increaser ("power transfer gear") between an electric motor and an output pinion, which in turn is coupled to a rack. The power transfer gear must possess numerous characteristics:
  - a. durability to withstand fatigue and high impact input in use;
  - b. high efficiency;
  - c. gear reduction range of 15:1 to 22:1;
  - d. package flexibility; and
  - e. cost effective.
7. Power transfer gears that Visteon has been using are crossed helical and worm gear designs. Worm gears have been found acceptable for rack loads below 8500 N, and crossed helical gears have been found acceptable for rack loads up to 14000 N, but these are insufficient for the high stress environment in larger vehicles, such as light trucks or larger vehicles.
8. While a roller gear was known to be able to handle higher loads, its complexity and other drawbacks led to numerous challenges that have discouraged its use for automotive purposes. For example, no prior solution existed for packaging the unit to be small enough to fit within the constraints of standard engine compartments, or how to design the unit against the vibratory challenges encountered in automotive use. To make a sufficiently small unit capable of handling higher loads was believed to require higher cost materials and special engineering of many parts for the rollers pins and seats. Further, it was believed that the higher load requirements, the greater complexity of the unit, and its consequent gear mass would lead to lower efficiency. Hence, no EPAS system has existed or been planned that used a roller gear.

9. Despite these challenges, the present inventions resulted in a roller gear that is surprising more efficient than a conventional worm gearbox. This is demonstrated in Figure 11 of the present application. At 1000 rpm, the roller gear of the present invention was found to be 10% more efficient than a worm gear. Yet the present invention is capable of handling significantly higher torque loads.
10. A further surprising result of the present inventions is that we did not have to resort to unusual high cost, high strength or exotic materials, but were able to design the present inventions from standard steel and aluminum and standard bearings.
11. One of ordinary skill in the art would find the present inventions both very surprising and useful, as they use standard materials, can meet various packaging requirements, handle higher loads, but yet are more efficient.
12. The uniqueness of the present inventions is evident by the fact that in the more than 100 years that roller gears have been known, and decades of power assist steering systems, no one has combined the two.
13. From my experience in the field and from obtaining a prior patent, I am aware that an invention must be novel and not obvious from the prior art. Further, I am aware of the cost and effort involved in the patenting process. I would not have pursued patenting the present invention through my employer unless it was new and not obvious. In this case, the inventions have surprising benefits not anticipated, such an increased efficiency, and use of a roller gear in a power assist steering system was discouraged for the reasons I mentioned above.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Edward Francis McElmeel

Edward Francis McElmeel

9/29/03

Date